Claims

1. A compound planetary gear system, comprising:
   a. one or more pairs of planetary gears of differing diameters each pair having a common axis and fixedly connected together and rotatable only as a single unit, said common axis attached to:
   b. a planetary gear carrier;
   c. a pair of coaxial sun gears consisting of a lockable sun gear (LSG) and a moveable sun gear (MSG), wherein said sun gears have differing diameters, independent axes, and are coaxial with said planetary gear carrier; and wherein a larger planetary gear meshes with a smaller sun gear, a smaller planetary gear meshes with a larger sun gear, and the sum of the radii of the smaller planetary gear and the larger sun gear is equal to the sum of the radii of the larger planetary gear and the smaller sun gear, and wherein said sun gears are interlocked by:
   d. a magnetic interlock, which causes said sun gears to rotate in synchrony, provided that a differential torque between said sun gears is weaker than said magnetic interlock;
   e. a locking mechanism which locks LSG to its axis, wherein when LSG is locked to its axis said differential torque between LSG and MSG is greater than said magnetic interlock and MSG rotates at the rotation rate of said planetary gear carrier multiplied by a gear ratio; and wherein when LSG is not locked to its axis said differential torque between LSG and MSG is less than said magnetic interlock and the two sun gears rotate at the rotation rate of said planetary gear carrier.

2. The compound planetary gear system of claim 1 wherein said gear ratio is $1/(1 - (PPa/PPb) \times (PSb/PSa))$, wherein *PSa* is a pitch diameter of said MSG, *PSb* is the pitch diameter said LSG, *PPa* is the pitch diameter of a planet gear that meshes with said MSG, and *PPb* is the pitch diameter of a planet gear that meshes with said LSG.

3. The compound planetary gear system of claim 1 additionally comprising:
   g. an input means connected to said planetary gear carrier; and
   h. an output means connected to said MSG.

4. The compound planetary gear system of claim 3 wherein said input means is connected to a motor.

5. The compound planetary gear system of claim 4 wherein said motor is selected from the group consisting of electric motor, radial flux induction motor, and hydraulic motor.

6. The compound planetary gear system of claim 5 wherein said electric motor is a high phase order induction machine drive system, comprising:

a) an inverter system for the synthesis of a plurality of phases of alternating current output, each phase electrically connected to at least one inverter terminal, and

b) an induction motor comprising N phases, where N is greater than 3, connected mesh to said inverter terminals, said mesh characterized in that:

each motor phase is electrically connected to:

(i) a first inverter terminal, and

(ii) a second inverter terminal S skipped terminals distant from said first inverter terminal in order of electrical phase angle, where S is the skip number and represents the number of skipped terminals;

and the phase angle difference between the two inverter terminals to which each motor phase is connected is identical for each motor phase.

7. The compound planetary gear system of claim 3 wherein said input means is connected to a load.

8. The compound planetary gear system of claim 7 wherein said load is an aircraft wheel.

9. The compound planetary gear system of claim 1 wherein said locking mechanism additionally comprises a ratcheting mechanism.

10. The compound planetary gear system of claim 4 wherein said locking mechanism additionally comprises a ratcheting mechanism and wherein said ratcheting mechanism releases said LSG when said planetary gear carrier rotates faster than said motor.

11. The compound planetary gear system of claim 1 wherein said locking mechanism is selectable by an operator, wherein when said locking mechanism is not selected said compound planetary gear system provides a slippy 1:1 ratio, and wherein when said locking system is selected said compound planetary gear system provides a reduction ratio.

12. The compound planetary gear system of claim 1 wherein said gears are selected from the group consisting of: spur gears and helical gears.

13. The compound planetary gear system of claim 2 additionally comprising:

i. a reverse gear unit disposed between MSG and said output means.

14. An aircraft ground wheel comprising a wheel mounted on an undercarriage axle, a motor, and the compound planetary gear system of claim 1, wherein said motor drives said input, and said output drives said ground wheel.

15. The aircraft ground wheel of claim 14 wherein said motor is located inside said nose wheel.

16. The aircraft ground wheel of claim 14 wherein said motor is located inside a fuselage of said aircraft.

17. The aircraft ground wheel of claim 16 wherein drive from said motor to said compound planetary gear system is provided by gearing.

18. The aircraft ground wheel of claim 17 wherein said gearing comprises belts.

19. A system for prerotating an aircraft's landing gear wheel prior to landing wherein the aircraft has at least one landing gear wheel attached to the aircraft by a support, comprising: means for measuring the true ground speed of the aircraft independently from the aircraft's airspeed; means for rotating said wheel at selective rotational speeds while the aircraft is airborne comprising the compound planetary gear system of claim 1 and a motor; means for measuring said rotational speeds of said wheel; and control means for operating said means for rotating said wheel, said control means being responsive to said means for measuring the true ground speed and responsive to said means for measuring said rotational speeds of said wheel, wherein said control means operates said means for rotating to selectively increased and decreased rotational speeds of said wheel to correspond to the true ground speed, and wherein when said locking mechanism is not selected and said compound planetary gear system provides a slippy 1:1 ratio.

20. A compound planetary gear system, comprising:

a. one or more pairs of planetary gears of differing diameters each pair having a common axis and fixedly connected together and rotatable only as a single unit, said common axis attached to:

b. a planetary gear carrier;

c. a pair of coaxial ring gears consisting of a lockable ring gear (LRG) and a moveable ring gear (MRG), wherein said ring gears have differing diameters, independent axes, and are coaxial with said planetary gear carrier; and wherein a larger planetary gear meshes with a smaller ring gear, a smaller planetary gear meshes with a larger ring gear, and the sum of the radii of the smaller planetary

gear and the larger ring gear is equal to the sum of the radii of the larger planetary gear and the smaller ring gear, and wherein said ring gears are interlocked by:

d. a magnetic interlock, which causes said ring gears to rotate in synchrony, provided that a differential torque between said ring gears is weaker than said magnetic interlock;

e. a locking mechanism which locks LRG to its axis, wherein when LRG is locked to its axis said differential torque between LRG and MRG is greater than said magnetic interlock and MRG rotates at the rotation rate of said planetary gear carrier multiplied by a gear ratio; and wherein when LRG is not locked to its axis said differential torque between LRG and MRG is less than said magnetic interlock and the two ring gears rotate at the rotation rate of said planetary gear carrier.

21. A compound planetary gear system, comprising:

a. one or more sets of planetary gears of differing diameters each set having a common axis and fixedly connected together and rotatable only as a single unit, said common axis attached to:

b. a planetary gear carrier;

c. a set of coaxial sun gears comprising a lockable sun gear (LSG) and a moveable sun gear (MSG), wherein said sun gears have differing diameters, independent axes, and are coaxial with said planetary gear carrier; and wherein a larger planetary gear meshes with a smaller sun gear, a smaller planetary gear meshes with a larger sun gear, and the sum of the radii of the smaller planetary gear and the larger sun gear is equal to the sum of the radii of the larger planetary gear and the smaller sun gear, and wherein said sun gears are interlocked by:

d. a magnetic interlock, which causes said sun gears to rotate in synchrony, provided that a differential torque between said sun gears is weaker than said magnetic interlock;

e. a locking mechanism which locks LSG to its axis, wherein when LSG is locked to its axis said differential torque between LSG and MSG is greater than said magnetic interlock and MSG rotates at the rotation rate of said planetary gear carrier multiplied by a gear ratio; and wherein when LSG is not locked to its axis said differential torque between LSG and MSG is less than said magnetic interlock and the two sun gears rotate at the rotation rate of said planetary gear carrier.